



EQUIPMENT HANDBOOK FOR LOW VOLTAGE DISCONNECTORS

LVD300	(15000248),
LVD400	(15000408) &
LVD500	(15000409)
LVD600	(15000218),
LVD1000	(15000264),

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	Outline drawing 0S-9023 (B524821)	Attached
	Circuit diagram 0S-9018 (B524682)	Attached

ISSUE RECORD

SERIAL NO. _____

Issue	Description	Date
1	New Document	17-10-95
2	Addition of 1000 A variant	20-12-95
3	Removal of external busbars	11-7-97
4	Master file converted in Word for Windows format Delete all references to Advance Power Systems and replace Advance Power in accordance with change form 12823 Amended section 2 part 9 Amended section 6, Commissioning, inserted a new paragraph 9.1 and renumbered following paragraphs accordingly.	09-08-99
5	Add 400A and 500A variants.	25-08-99
6	Change Brand Name to APC.	05-10-00
7	Changed the Part No. to the APC system. Change the part numbers quoted in the text to APC system.	27-03-01

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NOTE

This handbook covers five variants of Low Voltage Disconnectors (product codes 15000248 15000408, 15000409 15000218 and 15000264). The only differences between the five are the following:

- (1) The rating of fuse FS1 (300A for 15000248, 400A for 15000408, 500A for 15000409, 600A for 15000218 and 1000A for 15000264).
- (2) 15000264 has external busbars fitted.

SECTION 1: SAFETY INSTRUCTIONS

- 1 Before using the units, carry out the following:
 - 1.1 READ AND FOLLOW THE SAFETY INSTRUCTIONS.
 - 1.2 IF A FAULT IS FOUND WHEN IN USE, DO NOT PROCEED FURTHER WITHOUT CLEARING THE FAULT.
 - 1.3 CHECK THE UNIT VOLTAGE AND POLARITY AGAINST THE VALUE GIVEN IN THE INSTALLATION INSTRUCTIONS, SECTION 5.
 - 1.4 BECOME FAMILIAR WITH THE HAZARDS ASSOCIATED WITH THE UNITS.

WARNING

THESE UNITS CONTAIN THE FOLLOWING HAZARDS:

ELECTRICAL VOLTAGE
ENERGY
WEIGHT

ONLY COMPETENT PERSONS MAY WORK ON THESE UNITS.
IT IS IMPERATIVE THAT ONLY SKILLED SERVICE PERSONNEL BE ALLOWED TO INSTALL AND/OR REMOVE THE PROTECTIVE COVERS FOR SERVICING OR OTHER PURPOSES.
THE UNITS CONTAIN POTENTIALLY LETHAL VOLTAGES AND SOURCES OF HIGH ENERGY.

REFER TO MANUAL HANDLING, SECTION 8, BEFORE ATTEMPTING TO LIFT OR MOVE THE UNITS.

REFER TO THE FOLLOWING DOCUMENTS BEFORE COMMENCING WORK.
ALL WORK MUST BE CARRIED OUT IN ACCORDANCE WITH THE INSTRUCTIONS THEREIN:

- MANUFACTURER'S INSTRUCTIONS
- HEALTH AND SAFETY AT WORK ACT, 1974
- ELECTRICITY AT WORK ACT, 1989
- CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH (COSHH) REGULATIONS
- MANUAL HANDLING REGULATIONS.



SECTION 2: SPECIFICATION

INPUT

- 1 The input voltage is -54.5 V dc nominal from an external power system.

OUTPUT

- 2 The output voltage is -54.5 V dc nominal.

MECHANICAL

- 3 The units are housed in grey plastic boxes of dimensions 366mm wide x 193 mm deep x 470mm high. External busbars for input and output connections are provided on 15000264.

WEIGHT

- 4 The weight of the units are 15 kg.

OPERATIONAL TEMPERATURE

- 5 The operational temperature is -5 °C to + 50 °C.

OPERATIONAL HUMIDITY

- 6 The operational relative humidity is 5% to 95% non-condensing.

SAFETY STANDARDS

- 7 The units are for use in conjunction with telecommunications apparatus and are designed to meet the standard BS EN 60950 specification for safety of information technology equipment, including electrical business equipment.

ALARMS

- 8 One set of volt free change over contacts are provided on a terminal block (TB1) to indicate the state of the contactor.
- 9 The input and output sides of the fuse can be monitored via a 27k Ω resistor on TB2

SECTION 3: CIRCUIT DESCRIPTION

GENERAL

- 1 With reference to the circuit diagram in Appendix B, the units consist of a contactor and control circuitry to connect and disconnect the input voltage to and from the output. The units are typically used in line with a positive earth power system, between for example a power cubicle (input) and a battery (output).

DC CONNECTIONS

- 2 The input voltage on the negative input terminal is fed via fuse FS1 to the contactor BC1, which is normally closed, directly to the output at the negative output terminal. The positive common output cable from the external power system is not connected to the units (only an auxiliary input, capable of carrying a light current to power the LVD PCA is required).

LOW VOLTAGE DISCONNECTION

- 3 If the input voltage decreases to 42.5 V the contactor is de-energised and the contacts opened via a signal from the LVD PCA, which disconnects the output. The contactor is energised and the contacts closed, reconnecting the output when the input voltage increases to 51.5 V.
- 4 The remote contacts change over when the contactor is de-energised with the N/C and C terminals (terminals 4 and 5) on TB1 being opened and the N/O and C terminals (terminals 5 and 6) being closed.

MANUAL OVERRIDE

- 5 The keyswitch provides a manual override to de-energise the contactor irrespective of the input voltage, when set to the OPEN position.

REMOTE LOOP CONTACTS

- 6 The REMOTE LOOP contacts on TB1 terminals 1 and 2 are normally linked and if the link is broken the contactor is de-energised and disconnects the unit from the external equipment. When installed, this link can be replaced by a link to a remote location which is broken when an emergency occurs.



SECTION 4: CONTROLS AND INDICATORS

KEYSWITCH

- 1 The keyswitch, when set to the NORMAL position allows the contactor to operate normally as described in Section 3 Para 2. When set to the OPEN position the contactor control is overridden and the contactor is de-energised.

LVD PCA LED

- 2 LED1 on the LVD PCA is lit when the input voltage to the PCA is greater than the low voltage disconnection (LVD) setting, 42.5 V. During normal operation the LED is lit.

SECTION 5: INSTALLATION AND COMMISSIONING

GENERAL

- 1 When these units are used for indirect connection to datel and data networks, private circuits, PSTN and PBXs, the following caution must be complied with.
 - 1.1 When connection is made to the ALARMS port, take note that these ports do not provide insulation sufficient to meet the needs of BS EN 41003:1993. Apparatus connected to these ports should either be approved to BS EN 41003, or have previously been evaluated against British Telecommunications PLC (Post Office) Technical Guides 2 or 26 and given permission to attach to British Telecommunications networks. Other usage will invalidate any approval given to the apparatus. The ports are labelled in accordance with clause 5.2 of BS EN 41003 as follows:

'ALARMS - SAFETY WARNING See Instructions for use'
 - 1.2 In addition, if these ports are accessible for connection to other equipment external to the host equipment, this port must be suitably labelled. Interconnection directly or by way of other apparatus to the ports labelled 'SAFETY WARNING See instructions for use' with a port not so marked may produce hazardous conditions on the network and advice should be sought from a competent engineer before such a connection is made.

VOLTAGE MONITOR SETTINGS

- Note:** The exact monitor settings for individual units are measured and recorded prior to despatch from the factory, using precision voltmeters.
- 2 In order to avoid spurious fault reports, ensure that the following are observed when carrying out voltage measurement tests.
 - 2.1 Check that fuse FS2 is correctly inserted.
 - 2.2 Wait five minutes after connection of the dc power supply to allow the monitor circuits to stabilise.
 - 2.3 When observing the operating voltage of a monitor setting:
 - 2.3.1 Change the power supply voltage slowly and gradually by 0.05 V steps, pausing between each step.
 - 2.3.2 When a 0.05 V step results in monitor operation, record the voltage indication immediately prior to that step; this is the monitor operating voltage. (Ignore any change in voltmeter reading after operation.)
 - 2.4 When recording any apparent discrepancy in the service log (Appendix A), note both the reading observed and the voltmeter type used, together with its accuracy rating (e.g. 'Fluke 75: ± 0.14 V' or 'Fluke 77: ± 0.09 V'). Note that many portable multimeters are less accurate than might be suggested by the number of digits displayed.

PRE INSTALLATION TEST

- 3 If required, a pre installation test may be carried out prior to the installation and commissioning. This is basically a re-test of the power system against the test certificate found in Appendix B. The spare test certificate may be used to record the test results.

Note: A full pre installation test may not be possible, as specialised test equipment is required.

INSTALLATION

WARNINGS

- (1) THIS APPARATUS MUST BE INSTALLED BY A PROFESSIONAL INSTALLER. WHEN INSTALLED, A PROTECTIVE EARTH MUST BE PROVIDED FOR SAFETY, IN ACCORDANCE WITH BS6701: PART 1:1990: CLAUSE 6.10.

'WARNING: THE PROTECTIVE EARTH CONNECTION MUST BE HARD WIRED.'

- (2) EXERCISE EXTREME CAUTION WHEN WORKING OR MAKING MEASUREMENTS WITHIN THE UNITS. HIGH VALUE DC VOLTAGES MAY PRESENT A HAZARD OWING TO THE DANGER OF SHORT CIRCUITS. RINGS, WATCHES AND JEWELLERY SHOULD BE REMOVED AND ONLY INSULATED TOOLS SHOULD BE USED. A SOLDERING IRON SHOULD NOT BE USED UNLESS THE INPUT AND OUTPUT HAVE FIRST BEEN ISOLATED.
- (3) THESE UNITS USE POSITIVE EARTH. CAREFULLY OBSERVE THE CORRECT POLARITY WHEN CONNECTING THE UNITS.
- (4) LIVE WORKING MUST NOT BE CARRIED OUT ON THE UNITS UNLESS ABSOLUTELY NECESSARY. A CERTIFICATE OF LIVE WORKING MUST BE OBTAINED BY THE PERSONNEL INVOLVED BEFORE ANY LIVE WORKING IS COMMENCED.
- (5) REFER TO MANUAL HANDLING, SECTION 8, BEFORE ATTEMPTING TO LIFT OR MOVE THE UNITS.

Stage 1 - Unpacking

- 4 Unpack the unit and check that the unit is present and undamaged and includes a handbook and factory completed test certificate.

Stage 2 - Input connections

- 5 To connect the dc input cables to the unit, proceed as follows:
 - 5.1 Mount the unit on a suitable wall using the mounting hole on each corner.
 - 5.2 Ensure that the external power system intended for connection to the unit is switched off.
 - 5.3 Open the door, remove five screws and washers on the plastic plate and lift off the plate.
 - 5.4 Remove the circular plate from the bottom and feed the negative and auxiliary positive common input cables from the external power system into the unit.
 - 5.5 Connect the negative cable to either the internal negative input plate (for 15000218 and 15000248) or the external NEGATIVE IN busbar (for 15000264). Note that the unit does not require a positive common input cable.
 - 5.6 Connect the auxiliary positive common cable (to power the LVD PCA) to the AUX. terminal on TB1 (terminal 3).

Stage 3 - Remote loop connections

- 6 If required, remove the link from the REMOTE LOOP terminals on TB1 (terminals 1 and 2) and make connections to the terminals from a remote location.

COMMISSIONING

Stage 1 - Preparation

7 Proceed as follows:

- 7.1 Check that the pre installation test (if required) has been carried out as detailed in Para 4.
- 7.2 Check that the installation has been carried out satisfactorily as detailed in Paras 5 and 6.

Stage 2 - Power up sequence

8 Proceed as follows:

- 8.1 Set the KEYSWITCH to the NORMAL position.
- 8.2 Switch on the external power system and check that the contactor is energised (a click can be heard) and the dc voltage is present at the negative output terminal with respect to (wrt) the TB1 AUX. terminal (terminal 3).

Stage 3 - Output connections

9 To connect the dc output cable to the unit, proceed as follows:

- 9.1 Switch off the external power system and check that the contactor is de-energised.
- 9.2 If required, connect the appropriate monitor and LVD alarm cables to TB1 and TB2
- 9.3 Remove the circular plate from the top and feed the dc output cable into the unit.
- 9.4 Connect the negative cable to either the internal negative output plate (for 15000218 15000408, 15000409 and 15000248) or the external NEGATIVE OUT busbar (for 15000264). Note that the unit does not require a positive common output cable.
- 9.5 Refit the plastic plate using five screws and washers and close the door.
- 9.6 Power up the system as detailed in Para 8.

Stage 5 - Completion

- 10 Power up the unit and check for correct operation.
- 11 Complete all site documentation.



SECTION 6: ROUTINE MAINTENANCE

GENERAL

- 1 Routine maintenance should be carried out on a six monthly and annual basis as detailed below.

SIX MONTHLY CHECK

- 2 The following must be carried out every six months:

- 2.1 Check that the unit output voltage is within the normal operating limits of the external power system (refer to the power system manufacturer's handbook).

Note

Voltages outside the normal operating range may be attributed to a recent interruption of the dc supply.

- 2.2 Check that the LVD PCA LED is lit.
 - 2.3 Make a visual inspection for mechanical damage, signs of overheating and damaged cables, terminals and insulation.
 - 2.4 Check that all electrical connections and mechanical fixings are secure.

- 3 Record any faults in the service log.

ANNUAL CHECK

- 4 As well as the six monthly checks listed in Para 2, it is recommended that a battery discharge test is carried out on a battery connected to the unit output. For details, refer to the battery manufacturer's documentation.

SECTION 7: FAULT DIAGNOSIS AND REPAIR

GENERAL

- 1 The units are designed for maximum reliability, therefore faults during normal use are unlikely. If faulty operation does occur, the source of the failure can usually be readily determined by inspection of the LED on the LVD PCA and the status of the contactor.

WARNINGS

- (1) EXERCISE EXTREME CAUTION WHEN WORKING OR MAKING MEASUREMENTS WITHIN THE UNITS. HIGH VALUE DC VOLTAGES MAY PRESENT A HAZARD OWING TO THE DANGER OF SHORT CIRCUITS. RINGS, WATCHES AND JEWELLERY SHOULD BE REMOVED AND ONLY INSULATED TOOLS SHOULD BE USED. A SOLDERING IRON SHOULD NOT BE USED UNLESS THE INPUT AND OUTPUT HAVE FIRST BEEN ISOLATED.
- (2) THESE UNITS USE POSITIVE EARTH. CAREFULLY OBSERVE CORRECT POLARITY WHEN CONNECTING THE UNITS.
- (3) REFER TO MANUAL HANDLING, SECTION 8, BEFORE ATTEMPTING TO MOVE OR LIFT THE UNITS.

MAINTENANCE SPARES

- 2 It is recommended that a set of maintenance spares is held by the maintenance engineer, as detailed below:

<u>CIRCUIT CODE</u>	<u>DESCRIPTION</u>	<u>APC NUMBER</u>	<u>BS PART NUMBER</u>	<u>RECOMMENDED QUANTITY</u>
BC1	Contactor	451-9005	503770	1
FS1	Fuse, 600A (15000218)	515-0600	503772	1
	Fuse, 300A (15000248)	515-0302	503773	1
	Fuse, 1000A (15000264)	515-1001	503802	1
	Fuse, 400A (15000408)	515-0400	505300	1
	Fuse, 500A (15000409)	515-0500	505301	1
FS2	Fuse, 2A	516-9116	502739	1
-	LVD PCA	OP9445	524792	1

FIELD REPLACEABLE UNITS

- 3 In addition to the maintenance spares, the following components may be replaced on site should they become faulty:

<u>CIRCUIT CODE</u>	<u>DESCRIPTION</u>	<u>APC NUMBER</u>	<u>BS PART NUMBER</u>	<u>RECOMMENDED QUANTITY</u>
FS1	Fuse, 600A (15000218)	515-0600	503772	1
	Fuse, 300A (15000248)	515-0302	503773	1
	Fuse, 1000A (15000264)	515-1001	503802	1
	Fuse, 400A (15000408)	515-0400	505300	1
	Fuse, 500A (15000409)	515-0500	505301	1
FS2	Fuse, 2A	516-9116	502739	1

FUSE FAILURE

- 4 Fuse failure should be suspected when one or more of the following typical symptoms are observed:

<u>SYMPTOM</u>	<u>FUSE</u>
Contactors is disconnected at normal operating voltage.	FS1.
LVD PCA LED is extinguished at normal operating voltage.	FS2.

FUSE REMOVAL AND REPLACEMENT

- 5 Where possible, attempt to ascertain the reason for the fuse failure and correct the fault before replacing. The most likely cause is a short circuit on the relevant line.

FS1 removal and replacement

Caution

This procedure requires the system to be powered down.

- 6 To remove and replace FS1, proceed as follows:
- 6.1 Switch off and isolate the external power system and check that the contactor is de-energised.
 - 6.2 Disconnect the output cable at the battery end and wrap with two layers of insulating tape.
 - 6.3 Open the door, remove five screws and washers on the plastic plate and lift off the plate.
 - 6.4 Remove two nuts and washers from the fuse and lift off the fuse.
 - 6.5 Fit a replacement fuse and secure using two nuts and washers.
 - 6.6 Refit the plastic plate using five screws and washers and close the door.
 - 6.7 Remove the insulating tape from the output cable and connect to the battery negative terminal.
 - 6.8 Power up the system as detailed in Section 5 Para 8.

FS2 removal and replacement

Caution

This procedure may be carried out without power down of the system, providing that suitable care is taken.

- 7 To remove and replace FS2, proceed as follows:
- 7.1 Pull out the fuseholder from the bracket and remove the fuse from the fuseholder.
 - 7.2 Fit a replacement fuse into the fuseholder and push the fuseholder into the bracket.

LVD PCA FAILURE

- 8 Failure of the LVD PCA is suspected if the output is not disconnected at 42.5V or not reconnected at 51.5V. Failure of the PCA is also suspected if LED1 is lit at a voltage less than 42.5V or extinguished at greater than 42.5V.

LVD PCA REMOVAL AND REPLACEMENT

Caution

This procedure requires the system to be powered down.

- 9 To remove and replace the LVD PCA, proceed as follows:
- 9.1 Switch off and isolate the external power system and check that the contactor is de-energised.
 - 9.2 Disconnect the output cable at the battery end and wrap with two layers of insulating tape.
 - 9.3 Open the door, remove five screws and washers on the plastic plate and lift off the plate.
 - 9.4 Remove the fanning strip from the terminal block, remove four nuts from the PCA and lift off the PCA.
 - 9.5 Fit a replacement PCA to the unit and secure using four nuts.
 - 9.6 Refit the fanning strip to the terminal block.
 - 9.7 Refit the plastic plate using five screws and washers and close the door.
 - 9.8 Remove the insulating tape from the output cable and connect to the battery negative terminal.
 - 9.9 Power up the system as detailed in Section 5 Para 8.

CONTACTOR FAILURE

- 10 Failure of the contactor is suspected if the output is not disconnected at 42.5V or not reconnected at 51.5V. Before concluding that the contactor is faulty, check that FS1 has not failed.

CONTACTOR REMOVAL AND REPLACEMENT

Caution

This procedure requires the system to be powered down.

- 11 To remove and replace the contactor, proceed as follows:
 - 11.1 Switch off and isolate the external power system and check that the contactor is de-energised.
 - 11.2 Disconnect the output cable at the battery end and wrap with two layers of insulating tape.
 - 11.3 Open the door, remove five screws and washers on the plastic plate and lift off the plate.
 - 11.4 Remove two nuts on FS1 and lift off the fuse.
 - 11.5 Remove five nuts and washers holding the contactor to the two adjacent copper bars and remove the curved copper bar.
 - 11.6 Remove the eight push-on connectors on the contactor (four on the top and four on the side), noting the locations and the polarity of the diode.
 - 11.7 Remove four nuts and washers on the base of the bracket and lift the bracket and contactor out of the unit.
 - 11.8 Remove three nuts and washers on the bracket and lift off the contactor.
 - 11.9 Fit a replacement contactor to the bracket using three nuts and washers.
 - 11.10 Secure the contactor and bracket in the unit using four nuts and washers.
 - 11.11 Refit the eight push-on connectors to the contactor observing correct locations and correct polarity of the diode.
 - 11.12 Refit the curved copper bar and the contactor to the adjacent copper bars using five screws and washers.
 - 11.13 Refit FS1 using two nuts and washers.
 - 11.14 Refit the plastic plate using five screws and washers and close the door.
 - 11.15 Remove the insulating tape from the output cable and connect to the battery negative terminal.
 - 11.16 Power up the system as detailed in Section 5 Para 8.

SECTION 8: MANUAL HANDLING

GENERAL

- 1 This unit (weight 15 kg) presents a hazard.
- 2 The Manual Handling of Loads Regulations, 1993 require that all persons working on the equipment are familiar with the Regulations, that they take care to minimise risk of injury to themselves and others, that they are properly trained, and that the correct equipment is used. Safety shoes are to be worn.
- 3 If in doubt about methods, ability to handle the loads, training or equipment, do not proceed without first seeking advice from a Competent Person.

PREPARATION

- 4 Before commencing work, the following must be checked:
 - 4.1 The floor must be level, clean, firm and dry.
 - 4.2 The working area must be clear of obstacles which could obstruct movement or cause tripping.
 - 4.3 There must be adequate room for the operator(s), equipment and load.
 - 4.4 Lighting must be sufficient for the load, equipment, loading surfaces, potential hazards and working environment to be seen clearly.
 - 4.5 Sound levels must not be high enough to cause distraction.

METHOD

- 5 The following comments are not intended to replace other documents and training courses; only to serve as a guide and check-list. For full guidance, refer to the Regulations and supporting documents.
 - 5.1 Before lifting loads, stand as close as possible to the load.
 - 5.2 Keep the back straight and as vertical as possible.
 - 5.3 Use the leg muscles to lift in preference to the arms.
 - 5.4 Minimise twisting, stretching and stooping.
 - 5.5 Loads should be withdrawn/inserted evenly, without jerking, maintaining the load level and balanced with adequate support.



APPENDIX A: SERVICE LOG

The service log is to be completed on every occasion that routine maintenance is carried out, as detailed in Section 6.

SERVICE LOG			
DATE	ACTION	ACTIONED BY	
		NAME	SIGNATURE



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APPENDIX B: SYSTEM DRAWINGS

DRAWING

Test certificate	00524484	(A524484)
Outline drawing	0S-9023	(B524821)
Circuit diagram	0S-9018	(B524682)



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